Materials Science Forum
ISSN: 1662-9752, Vol. 1140, pp 63-72
doi:10.4028/p-e7lvBZ

Submitted: 2024-06-09
Accepted: 2024-10-20
Online: 2024-12-19

Study of Special Cements Based on Calcium and Barium Ferrites

SHABANOVA Galina[1,a], TARANENKOVA Victoria[1,b], SHARAPOV Mykhailo[1,c], MYRGOROD Oksana[2,d*], PIROHOV Oleksandr[2,e]

[1]National Technical University "Kharkiv Polytechnic Institute", 2, Kyrpychova str., Kharkiv, Ukraine, 61000

[2]National University of Civil Defence of Ukraine, 94, Chernishevska str., Kharkiv, Ukraine, 61023

[a]gala-shabanova@ukr.net, [b]taranenkova@ukr.net, [c]sharapov.m@ukr.net, [d*]mir-oksa@ukr.net, [e]pir.s@ukr.net

Keywords: pelletising, ternary compounds, phase formation, synthesis, high-iron cements.

Abstract. Pelletising, i.e. transformation of fine dusty materials into lump materials (pellets, briquettes, pellets), is an important technical task solved in many sectors of the national economy - ferrous and non-ferrous metallurgy, chemical industry and in a number of other industries. The process of pelletising ores and ore concentrates is of the greatest importance for the production of iron and steel, i.e. for ferrous metallurgy. The most common method of pelletising is pelletising - granulation of iron ore concentrates in special granulation plants, usually with the use of binders. As a result of pelletising, so-called pellets are produced, which are subjected to hardening firing (roasting pellets) or achieve the required level of properties without high-temperature treatment (non-roasting pellets) through the use of special binders. The current trend is the transition from firing methods of pellet hardening to non-firing (low-temperature) methods.

1 Introduction

A successful solution to the problem of agglomeration of thin iron ore concentrates was the production of pellets, first proposed in 1912 by Anderson (Sweden) and in 1913 by Brackelsberg (Germany). The production of iron ore pellets has recently developed in many countries around the world at a high rate and has currently exceeded 300 million tons/year [1, 2, 3, 4].

The pellet production technology is a combination of two stages of pellet formation by pelletizing the wet charge in special devices - pelletizers (production of raw pellets) and hardening the granules (by firing or non-firing methods) to give the pellets the strength necessary for storage, transportation to blast furnace shops and melting them in ovens [5, 6, 7].

The production of raw pellets occurs by rolling finely dispersed iron ore material moistened to a certain degree. Finely ground iron ore powder is a hydrophilic dispersed system characterized by intense interaction with water. In such a system, the desire to reduce energy is realized by reducing the value of surface tension at the interface (when interacting with water) and enlarging particles (as a result of their adhesion) [8, 9, 10].

The metallurgical properties of unroasted pellets are comparable to those of roasted pellets, but the process of their production is economically more favourable, as it allows to significantly reduce fuel and energy consumption, as well as to improve sanitary and hygienic conditions of labour [11]. The main condition for realisation of the process of production of annealed pellets is a scientifically substantiated choice of a binder, the hardening process of which ensures the success of the whole technology. The following requirements are imposed on binders used for pelletising iron ore concentrates: the binder should be fast-setting and provide high mechanical strength of pellets, optimal technological parameters of the pelletising process and its economy; it should not be a chemical ballast; it should not deteriorate metallurgical properties of pellets, i.e. not hinder ore recovery; it should not contain impurities harmful for blast furnace charge; it should not be scarce [12].

The development and application of high-iron cements is best suited to the idea of a complete match between the composition of the cement and the pelletised concentrate. For example, if the